

**REMARKS**

Table 2 in the specification has been amended in order to correct an obvious typographical error contained therein. Claim 3 has been amended to state that the solid acid catalyst is obtained by the method of Claim 1. No new matter has been added.

Claim 1 has been rejected under 35 USC 102(b) as being anticipated by Matsushashi et al. Claims 3 and 4 have been rejected under 35 USC 102(b) as being anticipated by Kawamata et al. Applicants respectfully traverse these grounds of rejection and urge reconsideration in light of the following comments.

As explained previously, the instant invention is directed to a method of preparing a solid acid catalyst containing crystalline metastannic acid which comprises the steps of preparing a support comprising a crystalline metastannic acid, bringing the support into contact with organic acid ions, then bringing the support into contact with a sulfate group-containing compound and then calcining the support.

The present invention is also directed to a solid acid catalyst obtained by the method described above in which the catalyst contains crystalline metastannic acid and has a tin content of not less than 30% by weight as metal in the catalyst, a sulfate group supported thereon and an absolute value of argon adsorption heat of 30 kJ/mol or more, which is used in acid-catalytic reactions.

The present invention is based on the discovery that a solid acid catalyst containing crystalline metastannic acid possesses an unexpectedly high catalytic activity when used in esterification and transesterification reactions. In order to have the properties associated with the presently claimed invention, it is critical that the catalyst be prepared according to the claimed method steps using the claimed reactants. It is respectfully submitted that the prior art

cited by the Examiner does not disclose the presently claimed invention.

As explained in the previous Response, the Matsushashi article discloses the preparation of a highly active solid superacid of sulfated tin oxide from a tin oxide gel, which was precipitated by the hydrolysis of  $\text{SnCl}_4$  and washed with an aqueous ammonium acetate solution, followed by exposure to aqueous sulfuric acid and then calcining. The catalyst of this reference is prepared by the same method as catalyst MO-858 shown in paragraphs [0024]-[0026] in the present specification. In contrast to catalyst MO-858, catalyst MO-817 shown in paragraphs [0027]-[0029] was prepared according to the present invention from metastannic acid as opposed to the acid catalyst of Matsushashi and catalyst MO-858 which was prepared from a tin oxide gel precipitated by the hydrolysis of  $\text{SnCl}_4$ . Shown below is a Table which compares the comparative catalyst M-858 prepared according to the process disclosed in Matsushashi and catalyst M-817 according to the present invention.

TABLE

	M-817	M-858
Tin content (wt.%)	70.6	71.4
Elemental sulfur content (wt.%)	2.44	1.96
Crystalline size (nm)	35	32
Specific surface area $\text{m}^2/\text{g}$	152	135
Median pore size (nm)	2.8	3.1
Argon adsorption heat (kJ/mol)	-31.0	-29.7
Reflectance at $1280\text{ cm}^{-1}$ (%)	40.7	52.8
Reflectance at $1220\text{ cm}^{-1}$ (%)	42.0	52.2
Soy bean oil conversation rate (%)		
After 4 hours	69.0	16.0
After 20 hours	67.0	12.0
Octanoic acid conversion rate (5) after 8 hours		
At reaction temperature $105^\circ\text{C}$	99.3	97.7
At reaction temperature $90^\circ\text{C}$	94.6	93.4

As can be readily seen from a comparison of comparative catalysts MO-817 of the present invention, which is prepared from metastannic acid, with comparative catalyst MO-858, which corresponds to the catalyst of Matsushashi et al, catalyst MO-858 has an argon adsorption heat of -29.7 kJ/mol, which is lower than 30 kJ/mol, and exhibits much lower conversion rates than catalyst MO-817 of the present invention in transesterification and esterification reactions due to its low catalytic activity. Additionally, catalyst MO-858 does not meet the reflectance requirement of Claim 4 of the present invention.

Since catalyst MO-858 and MO-817 are very close in tin and sulfur contents and crystalline size and the preparation procedures of these catalysts are the same in the latter steps after being treated with an aqueous ammonium acetate solution, one of ordinary skill in the art would have expected that both catalysts would exhibit similar results in catalytic activity in transesterification and esterification reactions and the properties of argon adsorption heat and reflectance in their infrared reflection spectrum. As the above Table clearly shows, catalyst MO-817 of the present invention exhibited unexpectedly superior catalytic performance over comparative catalyst MO-858 prepared according to the disclosure of Matsushashi et al. As such, Matsushashi et al not only does not anticipate the presently claimed invention under 35 USC 102(b), the presently claimed invention is clearly patentably distinguishable thereover given the properties of the catalyst of the present invention.

Kawamata et al discloses a process for the selective ortho-alkylation of phenolic compounds using a catalyst comprising chromium oxide, tin oxide, iron oxide and a sulfate radical. However, the sulfated catalyst containing tin oxide in the Examples of this reference are all prepared using tin chloride. Additionally, during the preparation of these catalysts, the catalyst support is not brought into contact with organic acid ions as required by the method of Claim 1 of

the present application. Claim 3 has now been amended to state that it is prepared by the method of Claim 1 which requires the step of contacting the support with organic acid ions. This establishes that the catalyst of the present invention is different from the catalyst disclosed in Kawamata et al.

Kawamata et al does not speak to the relation between the catalytic performance of the tin oxide-containing sulfated catalyst and the argon adsorption heat of the catalyst or the reflectance at  $1280\text{ cm}^{-1}$  and reflectance at  $1220\text{ cm}^{-1}$  in the infrared reflection spectrum of the catalyst and therefore has no disclosure with respect to obtaining a catalyst as required by Claims 3 and 4 of the present invention along with an expectation of the properties associated therewith. Mere compositional similarity neither teaches nor discloses the catalyst of the present invention since, as discussed above, comparative catalyst MO-858 has a similar composition to catalyst MO-817 yet this comparative catalyst does not meet the limitations of Claims 3 and 4 because it has an absolute value of argon adsorption heat less than 30 kJ, a reflectance at  $1280\text{ cm}^{-1}$  of 52.8% greater than the reflectance of 52.2% at  $1220\text{ cm}^{-1}$ . Therefore, it is respectfully submitted that the presently claimed invention not only is not anticipated by Kawamata et al, the properties associated with the catalyst of the present invention are more than sufficient to rebut any proper showing of prima facie obviousness under 35 USC 103(a).

Reconsideration of the present application and the passing of it to issue is respectfully solicited.

Respectfully submitted,

  
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